Effect of Corn Hybrid on Amount of Residue Available for Grazing

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Summary

Twelve corn hybrids were evaluated to determine differences in corn grain yield and crop residue DM. Hybrids did not differ in corn grain yield but differed in amount of stems, leaves, husks, and cobs. Differences also existed in the ratio of corn grain to total residue production and corn grain to leaf and husk, indicating potential differences in plant efficiency independent of the amount of grain produced.

Introduction

Many variables should be considered in the effective management of corn residue as a source of grazed forage. Cattle will select the highest quality parts of corn residue first. Wilson et al. (2004 Nebraska Beef Cattle Report, pp. 13-15) reported that husk (3.6% CP and 67% IVDMD) and leaf (7.8% CP and 47% IVDMD) were more palatable than stem (4.5% CP and 45% IVDMD) and cob (2.2% CP and 35% IVDMD). Fernandez-Rivera and Klopfenstein (1989, Journal of Animal Science, 67:597) observed that 65 to 72% of DM utilized was represented by leaf and husk. Therefore, relative amount of plant parts, as well as their quality, could affect performance by grazing animals. The objectives of our research were to determine 1) whether differences exist among hybrids in the amount of residue available for grazing and in the ratio of corn grain to total residue produced, and 2) whether residue from different corn hybrids differs in quality.

Procedure

Hybrids that represented a wide range of production traits were selected from test plots near Paxton and Scottsbluff, Neb. The following hybrids were evaluated at Paxton: Pioneer P0541XR, P1173HR, P1395XR, Dekalb 59-35, 61-04, NK N68B-GT, N74C-3000GT, Croplan Genetic 5757 VT3, Golden Harvest 8211 3000GT, and Midwest Genetics 76482R. Plots received center pivot irrigation and had a silt loam soil type. Dekalb 42-91 and Mycogen 2R416 were produced at Scottsbluff.

The plot contained four rows per hybrid and rows were 30 inches apart. Plants were selected randomly for each hybrid by measuring 100 ft then alternating between the four rows for each sample. Each plant was cut at ground level, and the entire plant was collected. Plant density was measured by counting the number of plants present in a 15 ft length of row.

Each plant was sorted into the following parts: stems, leaves (including leaf sheath), husks, cobs, and corn grain. Plant parts were dried in a forced air oven at 140°F to determine DM yield per plant. Plant part samples were composited into five samples per hybrid and analyzed for in-vitro organic matter disappearance (IVOMD). IVOMD was determined using a 48-hour incubation of 0.5 g of sample in a 1:1 mixture of McDougall’s buffer (1 g/L urea) and rumen fluid collected from ruminally fistulated steers. Samples were incubated in a water bath at 39°C and swirled every 12 hours. After incubation, samples were filtered, dried for 24 hours, and burned in an ash oven to determine the DM and OM content for the calculation of IVOMD.

Results

Corn grain yield among hybrids (251 bu/ac at 15.5% moisture; 11,813 lb/ac ± 319, DM basis) at Paxton were not different. Differences were present between hybrids in the amount of stems, leaves, husks, and cobs (Table 1). Total residue production (sum of stems, leaves, husks, and cobs) was different among hybrids. However, differences also existed in the ratio of corn grain to total residue production and corn grain to leaf and husk, indicating potential differences in plant efficiency. Wilson, et al. (2004 Nebraska Beef Cattle Report, pp. 13-15) reported an average of 16 lb leaf and husk produced per bushel grain

Table 1. Composition of corn residue components of 10 corn hybrids (dry matter).

<table>
<thead>
<tr>
<th>Hybrid1</th>
<th>5</th>
<th>8</th>
<th>10</th>
<th>21</th>
<th>25</th>
<th>29</th>
<th>35</th>
<th>38</th>
<th>46</th>
<th>48</th>
<th>SE</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain2, bu/ac</td>
<td>257</td>
<td>251</td>
<td>249</td>
<td>266</td>
<td>254</td>
<td>239</td>
<td>246</td>
<td>247</td>
<td>214</td>
<td>231</td>
<td>11</td>
<td>0.23</td>
</tr>
<tr>
<td>Stem, lb/ac</td>
<td>4411</td>
<td>4022</td>
<td>3896</td>
<td>3946</td>
<td>3760</td>
<td>3321</td>
<td>4521</td>
<td>4719</td>
<td>5384</td>
<td>4524</td>
<td>199</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Husk, lb/ac</td>
<td>808</td>
<td>993</td>
<td>828</td>
<td>811</td>
<td>882</td>
<td>984</td>
<td>1009</td>
<td>784</td>
<td>864</td>
<td>610</td>
<td>73</td>
<td>0.01</td>
</tr>
<tr>
<td>Leaf, lb/ac</td>
<td>2551</td>
<td>3173</td>
<td>2817</td>
<td>3133</td>
<td>2917</td>
<td>3010</td>
<td>3233</td>
<td>2991</td>
<td>3255</td>
<td>2603</td>
<td>184</td>
<td>0.05</td>
</tr>
<tr>
<td>Cob, lb/ac</td>
<td>1386</td>
<td>1628</td>
<td>1305</td>
<td>1396</td>
<td>1471</td>
<td>1387</td>
<td>1702</td>
<td>1412</td>
<td>1297</td>
<td>1123</td>
<td>79</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Total, lb/ac</td>
<td>9157a</td>
<td>9816b</td>
<td>8846a</td>
<td>9286a</td>
<td>9036a</td>
<td>8702a</td>
<td>10555b</td>
<td>9905ab</td>
<td>10782b</td>
<td>8860c</td>
<td>477</td>
<td>0.02</td>
</tr>
</tbody>
</table>

1Hybrids are as follows: 5, Golden Harvest 8211 3000GT; 8, Pioneer P0541XR; 10, Croplan Genetic 5757 VT3; 21, Dekalb 59-35; 25, Midwest Genetics 76482R; 29, NK N68B-GT; 35, Dekalb 61-04; 38, Pioneer P1173HR; 46, Pioneer P1395XR; and 48, NK N74C-3000GT.

215.5% moisture.
yield for corn producing 43 to 183 bu/ac. Leaf and husk produced per
bushel grain in the current study
ranged from 14 to 19 lb. Corn hybrids
differed in the amount of residue pro-
duced independent of the amount of
grain. The correlation was very low
(Figure 1).

Since corn hybrids differed in the
amount of residue they produced, pos-
sible differences exist in the amount of
residue available for cattle to graze. The
production of leaf and husk ranged
from 3,267 to 4,407 lb/ac. A 1,200 lb
cow will consume about 785 lb/month
in a corn residue grazing situation
(DM basis; NRC, 1996). Assuming a
50% utilization of the leaf and husk
13-15) the high and low husk and leaf
producing hybrids could support 2.8
and 2.0 cows/ac for one month. If corn
residue cost $6.00/ac, this would equate
to $2.15 and $2.90/cow monthly for the
high and low leaf and husk producing
hybrids, respectively. The findings of
this study indicate differences in total
residue, as well as the ratio of grain
yield to total residue, do exist among
hybrids. These differences can equate
to potential economic differences
among hybrids in the grazing value of
the corn residue.

There was variation in digestibili-
y among hybrids for the respective
plant parts (Table 2). However, the
digestibility among hybrids was not
consistent across plant parts. Greater
digestibility was observed for leaf
and husk material compared to stem
cob material, but varied among
hybrids. Digestibility of leaf or husk
material was not highly correlated
with leaf or husk residue weight
(R2 = 0.45, R2 = 0.07 for leaf, and
R2 = 0.23, R2 = 0.17 for husk). Wilson
reported a high correlation between
total leaf and husk material (DM lb/
ac) and grain yield (bu/acre; 2004
Nebraska Beef Cattle Report, pp. 13-
15), across a wide range of growing
conditions and hybrids. However, a
relationship among hybrids was not
observed in this trial (P = 0.87,
R2 = 0.004). Husk and leaf weight
(DM lb/ac) were correlated (Figure 1;
P = 0.03, R2 = 0.47); weight of husk
material increased as weight of leaf
material increased.

The two hybrids at Scottsbluff
had lower grain yields (Table 3).
The amount of residue was roughly
proportional to the grain yield. The
amount of leaf plus husk was 14 and
15 lb/bu. The in vitro digestibility of
the leaves and husks was generally
greater than the values for the leaves
and husks from Paxton.

Table 2. In vitro organic matter disappearance (%) of 10 corn hybrids from Paxton, Neb.

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>5</th>
<th>8</th>
<th>10</th>
<th>21</th>
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<th>35</th>
<th>38</th>
<th>46</th>
<th>48</th>
<th>SE</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Husk</td>
<td>60.5</td>
<td>56.8</td>
<td>56.0</td>
<td>56.1</td>
<td>54.5</td>
<td>55.7</td>
<td>56.0</td>
<td>57.0</td>
<td>58.0</td>
<td>58.5</td>
<td>1.1</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Leaf</td>
<td>51.5</td>
<td>52.1</td>
<td>52.1</td>
<td>50.7</td>
<td>50.8</td>
<td>52.0</td>
<td>49.9</td>
<td>51.8</td>
<td>50.9</td>
<td>51.9</td>
<td>0.6</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Stem</td>
<td>48.3</td>
<td>47.8</td>
<td>46.4</td>
<td>47.9</td>
<td>46.0</td>
<td>46.7</td>
<td>46.0</td>
<td>47.9</td>
<td>50.4</td>
<td>49.0</td>
<td>1.0</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Cob</td>
<td>47.1</td>
<td>48.2</td>
<td>46.6</td>
<td>46.9</td>
<td>47.0</td>
<td>45.2</td>
<td>46.8</td>
<td>51.0</td>
<td>49.1</td>
<td>52.6</td>
<td>1.0</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

1Hybrids are as follows: 5, Golden Harvest 8211 3000GT; 8, Pioneer P05-41XR; 10, Croplan Genetic 5757 VT3; 21, Dekalb 59-35; 25, Midwest Genetics 76482R; 29, NK N68B-GT; 35, Dekalb 61-04; 38, Pioneer P1173HR; 46, Pioneer P1395XR; and 48, NK N74C-3000GT.

Table 3. In vitro organic matter disappearance of two corn hybrids from Scottsbluff, Neb.

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>11</th>
<th>21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Husks2, lb/ac</td>
<td>806</td>
<td>724</td>
</tr>
<tr>
<td>Leaves2, lb/ac</td>
<td>1296</td>
<td>1475</td>
</tr>
<tr>
<td>Stems2, lb/ac</td>
<td>2073</td>
<td>1820</td>
</tr>
<tr>
<td>Cobs2, lb/ac</td>
<td>984</td>
<td>957</td>
</tr>
<tr>
<td>Grain3, bu/ac</td>
<td>152.2</td>
<td>143.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>In vitro Digestibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Husk, %</td>
</tr>
<tr>
<td>Leaf, %</td>
</tr>
<tr>
<td>Stem, %</td>
</tr>
<tr>
<td>Cobs, %</td>
</tr>
</tbody>
</table>

1Hybrids are as follows: 1, Dekalb 42-91; 2, Mycogen 2R416.
2Values reported on a dry matter basis.
315.5% moisture.